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ABSTRACT

At mid-twentieth century, the dominant framework for lesson design--the programmed instruction format--was derived from efforts to apply operant conditioning to human learning. Cognitive psychology soon offered an alternative view, represented by Robert Gagne's Events of Instruction, which became the dominant framework through the end of the twentieth century. More recent developments suggest that a new conceptual framework, offered by M. David Merrill, may provide an even more comprehensive synthesis of instructional research and theory than the previous ones. This ERIC Digest discusses the behaviorist model; the influence of cognitive psychology; Gagne's Events of Instruction; constructivist influences; and a new framework by M. David Merrill (2002), "First Principles of Instruction." First Principles proposes four phases to the instructional process--activation of prior experience, demonstration of skills, application of skills, and integration of these skills into real-world activities--with all four phases revolving around a problem. Includes one figure showing the First Principles framework. (Contains 14 references.) (AEF)

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A New Framework for Teaching in the Cognitive Domain

By Michael Molenda

For the past half century a central concern of instructional technologists has been not so much the production and use of instructional materials but rather the design of instructional systems—lessons, courses, and programs. This shift of emphasis occurred with the advent of the programmed instruction movement in the late 1950s when educators and instructional media specialists came to understand that the "magic" of teaching machines was not in the hardware but in the pedagogical design of the software. As media specialists morphed into instructional technologists and became immersed in programmed-instruction lesson design they found themselves in league with instructional theorists, grappling with the issue of how to structure a lesson for maximum learning impact.

At mid-twentieth century, the dominant framework for lesson design—the programmed instruction format—was derived from efforts to apply operant conditioning to human learning. Cognitive psychology soon offered an alternative view, represented by Robert Gagne's Events of Instruction, which became the dominant framework through the end of the twentieth century. More recent developments suggest that a new conceptual framework, offered by M. David Merrill, may provide an even more comprehensive synthesis of instructional research and theory than the previous ones.

The Behaviorist Model

The first major influence on instructional technologists' thinking about lesson design was B.F. Skinner's programmed instruction, which he created to instantiate the principles of learning that he and others had discovered in the operant conditioning laboratory (Skinner, 1954). The framework that evolved specified six major elements: "(1) an ordered sequence of stimulus items; (2) to each of which a student responds in some specified way; (3) his responses being reinforced by immediate knowledge of results; (4) so that he moves by small steps; (5) therefore making few errors and practicing mostly correct responses; (6) from what he knows, by a process of successively closer approximations toward what he is supposed to learn from the program" (Schramm, 1962, p. 2).

As research and practical experience accumulated, exemplified by Lumsdaine and Glaser (1960) and Glaser (1965), the generality of many of these principles came into question. For example, the sequence of experiences, the nature of the response, the timing of feedback, and the size of steps all appeared to be contingent on various learner and learning conditions. Programmed instruction's prescriptions were then broadened and reduced by Popham (1971) to four principles: (1) provide relevant practice for the learner, (2) provide knowledge of results, (3) avoid the inclusion of irrelevancies, (4) make the material interesting (p. 171).

Cognitive Psychology Influence

Since the 1960s instructional design has been informed increasingly by principles drawn from other sources, especially cognitive psychology. Cognitive models for instruction emphasize the importance of the learners' cognitive and affective processes in mediating the effects of instruction.

One branch of cognitive theory—information-processing theory—conceived the human learner as a processor of information, similar to a computer. In this view, represented by the work of Atkinson and Shiffrin (1968), sensory inputs are selected, encoded, and stored in short-term and possibly long-term memory. Later, well-stored information may be retrieved and used.

Another branch—assimilation theory—focused on the human learner's cognitive structure and the processes whereby new information was integrated into the overall structure. Ausubel (1980) described schemata as providing ideational scaffolding, containing "slots" that can be instantiated with particular cases. These schemata allow learners to organize information into meaningful units.

Gagné's Events of Instruction

Robert Gagné was a leading interpreter of learning theory into instructional theory. Early editions of his influential book, *Conditions of Learning* (Gagné 1965, 1977) proposed that the information-processing model of learning could be combined with behaviorist concepts to provide a more complete view of learning tasks. From descriptive theories of information processing Gagné deduced prescriptive theories about instruction methods ("external conditions of learning"). In subsequent editions he attempted to incorporate newer research findings into an overarching template for instructional planning. His list of nine Events of Instruction became a robust and influential conceptual schema for lesson design: "gaining attention; informing learners of the objective; stimulating recall of prior learning; presenting the content; providing 'learning guidance'; eliciting performance; providing feedback; assessing performance, enhancing retention and transfer" (Gagné & Medsker, 1996, p. 140).

Constructivist Influences

Other educational theories emphasize the importance of the ideas generated by learners themselves. Wittrock (1974) described a view of learning and instruction in which the "generations" performed by learners influence the success of instruction. Generations are mental activities performed by learners, such as summaries, pictures, analogies, and discussions. This emphasis on learner generation characterizes another view that became prominent in the late 1980s as constructivism, which proposes that "knowledge is individually constructed and socially co-constructed by learners based on their interpretations of experiences in the world" (Jonassen 1999, p. 217). Prescriptive principles from constructivism include: (1) embed learning in complex, realistic, and relevant environments; (2) provide for social negotiation as an integral part of learning; (3) support multiple perspectives and the use of multiple modes of representation; (4) encourage ownership in learning; (5) nurture self-awareness of the knowledge construction process (Driscoll, 2000, pp. 382-383).

A New Comprehensive Framework

A recent synthesis by M. David Merrill (2002) provides the most recent comprehensive framework for design of lessons aimed primarily at cognitive learning. It springs from an eclectic perspective and explicitly attempts to assimilate the prescriptions of a broad array of instructional theories.

Merrill's framework, which he refers to as "First Principles of

Instruction," proposes four phases to the instructional process: "(1) activation of prior experience, (2) demonstration of skills, (3) application of skills, and (4) integration of these skills into real-world activities" (Merrill, 2002)—with all four phases revolving around a problem, as shown in Figure 1 below.

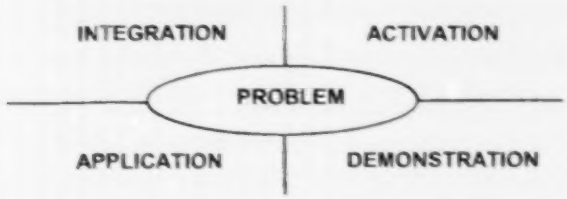

Figure 1. First Principles of Instruction. Copyright M. David Merrill, Utah State University. Reprinted by permission of the author.

Each of these five elements has supporting generalizations, which provide the prescriptions for effective instruction:

Problem-centered. Learning is promoted when learners are engaged in solving real-world problems. Some corollaries:

Show task: Learners are shown the tasks they they will be able to do.

Task level: Learners are engaged at the problem or task level, not just the operation or action level.

Problem progression: Learners solve a progression of problems that are explicitly compared to one another.

Activation Phase. Learning is promoted when relevant previous experience is activated. Some corollaries:

Previous experience: Learners are directed to recall, relate, describe, or apply knowledge from relevant past experience that can be used as a foundation for the new knowledge.

New experience: Learners are provided relevant experience that can be used as a foundation for the new knowledge.

Structure: Learners are provided or encouraged to recall a structure that can be used to organize the new knowledge.

Demonstration Phase. Learning is promoted when the instruction demonstrates what is to be learned rather than merely telling information about what is to be learned. Some corollaries:

Demonstration consistency: The demonstration is consistent with the learning goal (i.e., examples for concepts, demonstrations for procedures, visualizations for processes, and modelling for behavior).

Learner guidance: Learners are provided appropriate learner guidance including some of the following: they are directed to relevant information, multiple representations are used for the demonstrations, or multiple demonstrations are explicitly compared.

Relevant media: Media play a relevant instructional role and multiple forms of media do not compete for the attention of the learner.

Application Phase. Learning is promoted when learners are required to use their new knowledge or skill to solve problems. Some corollaries:

Practice consistency: The practice and posttest are consistent with the stated or implied objectives.

Diminishing coaching: Learners are guided in their problem solving by appropriate feedback and coaching, including error detection and correction, and when this coaching is gradually withdrawn.

Varied problems. Learners are required to solve a sequence of varied problems.

Integration Phase. Learning is promoted when learners are encouraged to integrate (transfer) the new knowledge or skill into their everyday life. Some corollaries:

Watch me: Learners are given the opportunity to publicly demonstrate their new knowledge or skill.

Reflection: Learners can reflect-on, discuss, and defend their new knowledge or skill.

Creation: Learners can create, invent, and explore new and personal ways to use their new knowledge (Merrill, 2002, pp. 45-50).

Gagne's Events of Instruction has had a long run as the premier conceptual framework for the design of instruction, but it may be time for a new paradigm, one that more explicitly reflects the growing consensus that "meaning-making" is at the heart of cognitive learning. Merrill's First Principles capture this idea, providing essentially a new paradigm for thinking about cognitive instruction. Time will tell whether Merrill's First Principles will supplant Gagne's model and for how long before yet another paradigm emerges.

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